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## DENTAL INVESTMENT MATERIAL

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This invention relates to a dental investment material and more particularly a material suitable for casting high melting alloys.

The object of the invention is to provide a dental investment material which will combine with the other necessary characteristics the possibility of being employed to cast high melting alloys without causing imperfections therein or corrosion thereon.

The most commonly used investment material for making dental casting of gold and similar alloys is a mixture composed chiefly of calcium sulphate hemi-hydrate and silica with various minor ingredients for especial purposes. A widely used composition of this kind is made in accordance with my Patent No. 1,924,874, for "Method of making dental castings and composition employed in said method," which issued August 29, 1933.

Investment materials of this type are very satisfactory for ordinary gold alloys, but with gold alloys containing platinum or iridium so that they melt at 2300° F. or higher and for alloys of chromium, nickel, cobalt and beryllium, with similar high melting points, investment material containing calcium sulphate hemi-hydrate has not been fully satisfactory. When such high temperatures are reached, $SO_3$ and $SO_2$ are released in such quantities as to have a troublesome corrosive effect upon the metal. These gases are released to some extent at 1800° F., but the difficulty becomes much more marked at temperatures above 2000° F., and has prevented the making of satisfactory castings in this type of mold at 2300° F., or above. The result has been that high melting alloys of the type mentioned above, when cast in molds made of standard materials including calcium sulphate hemi-hydrate, would have imperfections, especially roughened surfaces.

By my present invention, the commonly used investment material containing calcium sulphate hemi-hydrate, such as disclosed in my above cited patent, can be employed for casting these high melting alloys without producing the imperfections due to corrosion. This is effected by including in the investment material compounds which will release neutral gases during the heating of the investment material and in this way prevent any released sulphur compounds from producing corrosive effects. While various materials which introduce inert or protective gases may be employed, substances releasing carbon dioxide have been particularly available and useful. Consequently, the use of these materials will be described more fully.

It has been found desirable to introduce materials which will release carbon dioxide during the heating up of the mold and will continue to do so when the final temperature is reached during the casting operation. The release of the carbon dioxide during the earlier heating stages fills the mold and the pores thereof with the gas, but it is desirable that the release of carbon dioxide shall be continued due to the heat of the metal in the casting operation so as to more fully protect the casting from the action of the sulphur compounds. The continuous release of the carbon dioxide is most easily effected by employing several different compounds which will result in the release or production of carbon dioxide at successive stages of heat. In one very convenient combination of such compounds, oxalic acid or a salt thereof, such as calcium oxalate for example, may be used to produce carbon dioxide at relatively low temperatures. For the next stage, one or more salts of carbonic acid such as calcium carbonate may be employed, which will release carbon dioxide during the intermediate stages of heating. For the production of carbon dioxide during the final stages of heating, carbon may be employed in any convenient form. Lamp black, powdered charcoal, colloidal graphite and flake graphite have been used with success. The free carbon continues to unite with oxygen at casting temperatures as high as 2300° F. It will be readily understood that the compounds cited are mentioned by way of example and other equivalent compounds may be employed, although those noted are readily available and in practice have given good results. The inclusion of 1% each of calcium oxalate, calcium carbonate and graphite in an investment material such as described in my above cited patent has been found sufficient to prevent the corrosive effects of the sulphur compounds when casting alloys such as mentioned having a melting point of 2300° F. or higher.

As is well known, oxalic acid decomposes so as to release carbon dioxide to a material extent at 320° F. and while some of the oxalates are more resistant they begin to decompose well below 1000° F. Calcium oxalate, for example, decomposes to a material extent at a temperature of 600° F. Therefore this invention provides an investment material which begins to release carbon dioxide at a temperature below